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Economic Analysis of Plantain Production System in Oyo State, Nigeria

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ABSTRACT

The study examined the economic analysis of plantain based production system in Oyo State, Nigeria. A multistage random sampling technique was adopted in the selection of Eighty three farmers from the chosen local governments. Well structured questionnaire was used to elicit information on socio-economic characteristics and other relevant variables. The study data were analyzed by descriptive statistics, budgetary and stochastic frontier production function. The result showed that 84.34% of plantain farmers in the study area are male and 84.34 of them were married. Plantain was predominantly grown as sole crop by 54.22% while 45.78% of farmers engaged in intercropping. Budgetary analysis revealed that plantain intercropping with yam had higher gross margin (₦528,400/ha) than sole plantain (₦449,940/ha). Yield level was positive and significantly influenced by labour input. The level of education was significant and found to contribute positively to technical efficiency while farming experience was found to reduce technical efficiency. Inadequate credit (96.39), Pest and disease (65.06%), labour shortage (60.24%), inadequate fertilizer (57.83) and sucker procurement (54.21%), were the prominent constraints to plantain production in the study area.

Keyword: ***Plantain based farm, budgetary analysis, stochastic production function.***

INTRODUCTION

The phenomenon of Crop productivity and growth to a large extent hinges on the input – output relationship. Plantain is one of the most important staple food crops grown in the tropics and sub-tropics of the world. Frison and Sharrok, (1999) observed that banana and plantain represent more than 25 percent of the food energy requirement of Africa.

Plantain plays vital roles in the feeding systems of both human beings and farm animals. It has a very high nutritional value in source of dietary carbohydrates, vitamins and minerals. Plantain are extremely rich in Vitamin A. Inspite of the consumption of plantains as a staple food, it is also used in the food industries for the manufacture of chips, flakes, cakes, thereby creating employment opportunities to the populace directly and indirectly and invariably sources of income for small holder farmers. At the household levels, plantains are consumed raw with water, soaked garri, fried as dodo, boiled, roasted

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and can be dried and grounded into flour for feature use.

Production of plantain in Nigeria between 1990 to 2004 indicates a downward trend in terms of yield per hectare while price per ton have steadily increased within the period (FAO, 2006, FAO STAT, 2011).

However, only eight African countries were named among the top ten world producers of plantain with Nigeria ranking as fifth highest producer of the crop (FAO, 2004). In terms of total production the banana ranks after oranges, grapes and apples, but when plantain production is added, it becomes the world's number one fruit crop.

According to Begg *et al,* (1984) when the economy is producing the maximum possible quantity of the goods given the resources and technology available, the economy as a whole is said to be efficient. It therefore means that optimal production is achieved when the available resources are utilized fully. Plantain being a major staple food in the humid tropics is not exonerated from some of the cost associated with other food crops. Yet, sustainable production of plantain in African is crucial to secure food and provide income to millions of people.

Plantains (*Musa Paradisiaca*) can contribute a lot to the economy of Nigeria if adequate attention is given to it. It is an economic crop which has a relatively high value product in common with most horticultural crops. Plantain has always been an important staple food for both rural and urban populace. It supplies up to 25% carbohydrate for appropriately 70 million people in the humid region of sub – Saharan Africa. (Ferris, 1997 and Swennen, 1990).

Nigeria is the largest producer of plantain in West African with annual production of about 2.4 million metric tons mostly obtained from the southern states (Ogozi, 1996).

The growing of plantain is left in the hands of the subsistence farmers who account for about 80% of Nigeria's agricultural output. The crop is grown in the backyard or home steads and recently in plantations for the commercial market. Acceptable to Nigerian, plantain is a versatile food in the kitchen as well as a raw material for many popular delicacies and snacks. This reason including the growing population of Nigeria leads to an enormous increase in demands for the crop in the consumers market. Among plantain products are plantain flower chips, beer and ethanol. The ripe one are sliced and fried in oil as "dodo".

In some parts of Nigeria, selling of roasted plantain, "boli" and fried whole fruits, "Ogene" are both thriving businesses that provide job opportunities for thousands of young girls and women. Although, this kind of employment is somewhat part – time in nature as a result of seasonality in supply. Moreover, plantation is relished by livestock. The peels constitute valuable fodder for goat and sheep when the peels and stalk holding the fruits are burnt, the resultant ash could be used singly or mixed with other ingredients to produce local soap popularly called black soap. Even the dry leaves are not left out as they are used in substantial quantities in the packaging and preservation of kolanuts.

Over – ripe ones are both compacted and fried in oil as "dodo ikire" mixed with plantain flour to make "eruku", a delicious local dish. Plantain serves as a source of income for small holders who produce it at the compound farms, mixed farms and small – scale sole plantain farms (Bayeri, 1996).

Nutritionally, plantain as a good source of carbohydrates is also reach in potassium and vitamins. Gastro – intestinal disorders like diarrhea can be treated with plantain (Ogazi, 1996).

The fresh juice from plantain trunk, fruit stalk and leaves is a healing and soothing remedy to burns, it can also be used as an anti – bleeding on wounds (Ogbonna, 1999).

The unripe fruits when roasted and eaten regularly aid sexual performance. All these attributes of the product offer it a high demand in the market.

SAMPLING TECHNIQUE

A multistage sampling technique was used in selecting the respondents. Based on apriori information two local government areas with highest density of plantain farmers were selected using purposive sampling technique. The second stage was the random selection of thirty percent of producers from each local government areas based on the total number of plantain farmers identified. In all a total of eighty five (85) respondents were selected for the interview in which eighty three (83) questionnaire were analyzed.

DATA COLLECTION

Primary data were collected using structured questionnaire on farmers output, production input variables (farm size, labour used, fertilizer, cost of seed, chemicals, transportation cost, harvesting cost, depreciation and rent). Also included in the data collection were the socio economic characteristics of the farmers (age, education, farming experience, household size, credit availability, gender and marital status). All data on resource use, production cost and outputs were converted to per hectare equivalent.

METHOD OF DATA ANALYSIS

Data were analyzed using descriptive and quantitative statistical techniques. Farm budget analysis was constructed to estimate the production cost, revenue and gross margin accruable to the farmers. The equation used in estimating the various parameters were defined below:

$$GM = TR - TVC \quad (1)$$

$$TC = TFC + TVC \quad (2)$$

$$NP = TR - TC \quad (3)$$

Where

TC = Total Cost, TFC = Total Fixed Cost, TVC = Total Variable Cost

GM = Gross margin, TR = Total Revenue, NP = Net Profit

Depreciation on tools was calculated by the straight line method as follows:

Depreciation = (Cost of Purchase – Salvage value)/ useful life.

STOCHASTIC FRONTIER

The model was employed to examine factors influencing output of plantain among farmers in the study area and the technical efficiency of resources used. The main strength of the model is that it deals with stochastic noise and permits statistical test of hypothesis pertaining to production structure

and degree of efficiency. Efficient transportation of inputs into output is characterized by the production function which shows the maximum output obtainable from various input vectors. The stochastic production function is defined as:

$Q = f(X_i\beta) \exp(V_1 - U_1)$..... (4)

Where

Q = Quantity of plantain Output

X_1 = vector of input quantities

β = vector of parameters to be estimated

EXP = expontential functions

Vi = Random variables

Ui = non negative random variables which are account for technical inefficiency in production.

The random errors, Vi, are assumed to be independently and identically distributed and independent of Ui's. V capture variation in output due to factors outside the control of the farmers like fluctuations in input prices and farm size. The V's are also assumed to be independently and identically distributed (Meeusen and Van den Broeck, 1977, Aigner et al. 1977). U's are factors under farmers control, it follows half normal distribution and it is a non negative random variable called technical efficiency of plantain production. It captures the variation in output due to age, household size, farming experience extension visit and level of education.

Technical efficiency (TE) of an individual farmer is defined as the ratio of the observed output to the corresponding frontier output, conditional on the level of inputs used by the farmer. Thus, the technical efficiency of farmer i in the context of the stochastic frontier production function (1) is:

TEi = Yi/Yi* = f(Xi, β) exp (Vi – Ui)/f (Xi β) exp (Vi) ..... (5)

TE = exp (- Vi) ……. (6)

Where Yi is the actual output and Yi* is the frontier output (Potential output). The value of the technical efficiency lies between zero and one. The most efficient farmer will have value one. Whereas the less efficient farmers will have their efficiencies lying between zero and one.

Table 1. Socio Economics Characteristics of the Respondents

Personal Characteristics	Categories	Frequency	Percentage (%)
Sex	Male	70	84.34
	Female	13	15.66
		83	**100.00**
Age	Below 30	10	12.05
	30 – 39	38	45.78
	40 – 49	29	34.94
	50 – 59	4	4.82

	Above 60	2	2.41
		83	**100.00**
Marital Status	Single	9	10.84
	Married	70	84.34
	Separated	4	4.82
		83	**100.00**
Educational	No formal Education	8	9.64
Qualification	Primary	10	12.05
	Secondary	15	18.07
	Tertiary Education	50	60.24
		83	**100.00**
Experience	1 – 5 years	38	45.78
	6 – 10 years	32	38.55
	11 – 15years	13	15.66
		83	**100.00**
Household size	1 – 3	15	18.07
	4 – 6	38	45.78
	7 – 9	18	21.69
	Above 10	12	14.46
		83	**100.00**
Access to loan	Yes	33	39.76
	No	50	60.24
		83	**100.00**
Extension Visit	Yes	65	78.31
	No	18	21.69
		83	**100.00**

Source: Field Survey, 2014

Result and Discussions

Table 1 described the socio economics characteristics of the respondents. The results of the analysis showed that majority (84.34%) of the respondents were male while only 13 were female representing 15.66%. This indicates dominance of male folk in plantain production. Seventy seven (77) of the respondents were below 50 years with the percentage of 92.77, revealing presences of young and middle aged individuals who are

known to be active and innovative. They are also likely to be opened to new ideas. Furthermore, 70 of the farmers with the percentage of 84.34 were married and are therefore expected to be stable and settled carrier-wise. Eight (8) of the respondents with percentage of 9.64 did not have any formal education, 10 farmers with percentage of 12.05, had primary education, 15 with the percentage of 18.07 had secondary education and 50 farmers with percentage of 60.24 had tertiary education. This shows high level of literacy in the study area. The result also indicated that 45 of the respondents with the percentage 54.21 are into the practice of plantain production for more than 5 years, 32 of them with the percentage of 38.55 had grown plantain between 6 – 10years while 13 with the percentage of 15.66 had grown plantain between 11 – 15years. The mean years of experience in plantain production was 6 years. These further shows that plantain production is newly introduced crop farming in the study area. The mean household size was 6. This indicates that the household size of respondents were relatively large.

Credit facilities were not readily accessed by 50 respondents with the percentage of 60.24. This is attributed to the absence of micro financial institutions in the area. Agricultural extension services were reached by 65 of the farmers with the percentage of 78.31 in the study area. This had enable farmers to have access to improved technologies involved in production of the crop.

Table2: Cropping Pattern Adopted by Farmers

Personal Characteristics	Categories	Frequency	Percentage
Cropping System	Sole Plantain	45	54.22
	Plantain	38	45.78
	intercrop	**83**	**100.00**
Intercrop System	Plantain – Cassava	18	21.69
	Plantain – Yam	50	60.24
	Plantain – Cocoa	10	12.05

	Plantain – Citrus	5	6.02
		83	**100.00**
Reason for Intercropping	Improved Income	45	54.22
	Increased fertility	7	8.43
	Prevention against crop failure	20	4.10
	Maximum use of land	11	13.25
		83	**100.00**
Plantain Variety	Broad Leaf	38	45.78
	Healing blade	32	38.55
	Bird seed	13	15.66
		83	**100.00**
Methods of Planting	Direct Planting	70	84.34
	Transplanting	13	15.66
		83	**100.00**
Farm size	Below 1ha	25	30.12
	1 – 2ha	35	42.17
	3 – 4ha	13	15.66
	5 – 6ha	6	7.23
	Above 6ha	4	4.82
		83	**100.00**

Source: Field Survey, 2014

Cropping pattern employed by farmers

From Table 2, it can be seen that plantain was predominantly grown as sole crop by 45 farmers representing 54.22%, while 38 farmers representing 45.70% engaged in intercropping. Plantain was intercropped with cassava, yam, cocoa and citrus in the study area. Eighteen (18) respondents however, representing 21.69% intercropped with cassava, 50 respondents representing 60.24%, intercropped with yam, 10 respondents representing 12.05%

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with cocoa, 5 respondents representing 6.02% with citrus. The reasons given for intercropping plantain with other crops by such category of farmers were improved income with percentage 54.22, by 7 farmers were increased fertility with percentage 8.43, by 20 farmers were prevention against crop failure with percentage of 24.10, and by 11 farmers were maximum use of land with percentage of 13.25.

Although broad leaf and healing blade were the most commonly grown varieties of plantain in the study area. Thus, 38 respondents representing 45.78% preferred broad leaf variety. This was attributed to the inherent market value, good taste, large size and storability with respect to the method of direct planting of the broad leaf variety. It was also discovered that direct seeding method of planting was the popular technique adopted by 70 respondents representing 84.34% of the sampled farmers.

Thirty five (35) farmers with the percentage 42.17 had between 1 – 2ha, 25 with percentage of 30.12 had less than 1ha and only 4 farmers with percentage of 4.82 had more than 6 hectares. This showed that most of the farmers operated as small scale enterprise. The table also showed that majority of the respondents relied on hired labour (50.8%) for their farm operation while some (35.6%) depend on both family and hired labour.

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Table 3: Average Cost and Profitability per Hectare of Plantain

Variables	Sole Plantain farm		Plantain – Yam Farm	
	Amount/ha	% of VC/TVC	Amount/ha	% of VC/TVC
Revenue				
Value of plantain	655,000	100	550,000	73.3
Value of other crops			200,000	26.7
Total Revenue (TR)	655,000	100	750,000	100
Variable Cost				
Seed	6,000	2.9	12,600	5.68
Fertilizer	8,000	3.9	6,000	2.70
Chemicals	2,400	1.17	3,000	1.35
Hired Labour	188,660	92.00	200,000	90.25
Total Variable cost	205,060		221,600	100
Gross margin/ha	449,940		528,400	
Fixed cost				
Rent on Land	3,000		3,000	
Depreciation	1,500		1,500	
Total Fixed cost	2,833		2,833	
Total Cost (TC)	207,893		224,433	
Net margin/ha	447,107		525,567	
B/C ratio	1:2:35		1:2:13	

Source: Field Survey, 2014

Cost and Returns structure

The estimates of the budgeting analysis for sole and plantain intercropped are presented in Table 3. The average gross margin generated by sole plantain farms was ₦449,940/ha which was lower than ₦528,400/ha recorded on farms that intercropped plantain with yam. Similar trends (higher income with intercropping) were also observed by Aihonsu (2002). This may probably be the reasons why plantain yam intercropped was popular among the farmers.

However, the benefit to cost ratio of sole plantain (2.35) was higher than that of the intercropping system (2.13). In term of the cost structure, hired labour accounted for almost 90 percent of total variable cost for both sole plantain and inter crop enterprises. While seed, fertilizer and chemical accounted for the remaining 10%. This probably indicates high labour requirement in plantain production. From this result, it can be concluded that Plantain production is profitable based on the fact that an average farm investment in the area recorded over 100 percent returns on investment.

Table 4: Estimate of the stochastic production function

Variable	Parameter	Coefficient	T – value
Frontier Production Function			
Constant	β_0	0.44	4.54**
Ln Seed quantity	β_1	0.63	-4.03
Ln Chemical quantity	β_2	-0.16	-1.2
Ln Fertilizer quantity	β_3	-0.27	-8.65
Ln Farm size	β_4	0.47	6.32
Ln Labour Input	β_5	0.11	4.87***
Technical Inefficiency Function			
Constant	ϵ_0	0.32	7.6**
Age	ϵ_1	0.13	1.45
Household size	ϵ_2	0.13	0.07
Farming experience	ϵ_3	0.16	1.68*
Extension visit	ϵ_4	-0.17	-1.02*
Level of Education	ϵ_5	-0.87	2.32**
Variance Parameters			
Sigma Square	ϵ_2	0.75	5.57
Gamma	Γ	0.44	-3.24
Log Likelihood	Lif	-0.68	

*****, **, * significant at 1%, 5% and 10% respectively.**

Source: Field Survey, 2014

Factors that influences output and technical efficiency of plantain farmers

The result of the estimated production frontier and technical efficiencies were presented in Table 4. The result showed that estimated co-efficient of labour input was positive and significant at 1% level. This means that the output will increase as the level of these independent variable (labour) increases. This conforms to the findings of Adebayo (2006), Ajibefun and Abdulkadri(2004), Ajibefun *et al.,* (2002) and Ogundele and Okoruwa (2006). They all showed that hired labour contributed positively to farm productivity in the dry savannah and humid forest agro – ecological zones of Nigeria.

For technical inefficiency effect, the coefficient of household size variable showed a positive relationship and was not significant. This suggests that increase in household size may increase technical inefficiency in the study area. The coefficient of education showed a negative relationship with the predicted technical inefficiency effect and was significant at 5% level. This implies that increase in years of schooling reduces technical inefficiency or improves efficiency. This agrees with the findings of Adetiba (2005), Ajibefun and Abdulkadri (2004) and Kehinde (2005).

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They confirmed that education was a key to enhanced productivity among farming households in the humid forest, dry savannah and moist savannah agro-ecological zones in Nigeria.

The coefficient of extension visit was also negative though not statistically significant. This implies that farmers that received more extension visit tend to be less inefficient and thus more efficient. The positive coefficient of age also indicates that older farmers tend to be less efficient in the production of plantain.

Table 5: Distribution of Technical Efficiencies

Efficiency	Number of farmers	Percentage (%)
20 – 29.99	20.00	25.00
30 – 39.99	50.00	62.50
40 – 49.99	08.00	10.00
50 – 59.99	02.00	2.50
Total	**80.00**	**100.00**
Mean	33.00	
Minimum	26.42	
Maximum	56.20	

Source: Field Survey, 2014

Table 5 summarized the TE distributing of the studied farmers. There were variation in the level of efficiency among the farmers ranging from a very low efficiency (26.42%) to farmer that had TE of 40% and above.

Table 6: constraints to plantain production

Constraints	Frequency	Percentage	Ranking
Inadequate Credit	80	96.39	1st
Pest and Disease	54	65.06	2nd
Labour Shortage	50	60.24	3rd
Inadequate fertilizer	48	57.83	4th
Inadequate transportation	43	51.81	6th
Sucker Procurement	45	54.21	5th
Poor Marketing	43	51.81	6th
Pilfering	42	50.60	7th
Inadequate technical know how	35	42.17	8th

*Multiple options allowed.

Source: Field Survey, 2014

Constraints of Plantain Production

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Constraints to plantain production in the study area are shown in Table 6. Inadequate credit ranked first among the constraints. The second most pressing challenged as depicted from the table is pest and diseases problem. Others include labour shortage, inadequate supply of inputs like fertilizer and suckers, and inadequate transportation, among other constraints faced in the study area.

CONCLUSION AND RECOMMENDATIONS

The study revealed that plantain production is profitable in the study area. The study further revealed that the production level was significantly influenced by labour input while level of education was identified significantly to contributing towards increased farmer's efficiency. Based on the findings from the study, the following recommendations were made:

- Credit facilities should be made not only available but also affordable to plantain farmers, with zero or low interest rate.
- More research on plantain should be encouraged especially in the areas of diseases and pests control. This will go a long way in solving the problem of infestation during the growing season, and
- Adequate modern equipments/tools used in plantain production should be provided to the farmers to curtail the incessant labour shortages usually experienced by the farmers.
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